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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/220,970	12/23/98	MILLS	R 9213-4

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EXAMINER	
CHEN, W	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

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1- File Copy

Office Action Summary	Application No. 09/220,970	Applicant(s) MILLS, RANDELL L.
	Examiner Wenpeng Chen	Art Unit 2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 09 February 2001 and 03 April 2001.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-322 is/are pending in the application.

4a) Of the above claim(s) 1-50 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 51-66,69-95,98-176,181-205,208-231,233-276 and 278-322 is/are rejected.

7)☒ Claim(s) 67,68,96,97,177-180,206,207,232 and 277 is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 23 December 1998 is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
18) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

Examiner's Statement

1. In view of the Appeal Brief filed on 4/3/2001, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(a) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(b) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

2. The rejections of Claims 51-322, set forth in paper #9, under 35 USC § 112, first paragraph are withdrawn

As explained in Specification section below, the specification can cause confusion. Because of the confusion, Claims 51-322 were rejected under 35 USC § 112, first paragraph in the previous Office Action by Examiner Tadayon under his reasonable interpretation. Examiner Tadayon has left USPTO. Continuous execution of this case was assigned to the present Examiner Wenpeng Chen.

Examiner Chen has reviewed the specification. He had similar confusion at first. With the explanation provided by the Applicant as discussed in Specification section below, Examiner

Chen concluded that the specification could enable a person skilled in the art to follow the procedure to implement the method with some amendments suggested below by the Examiner. The amendments include (1) clarifications of terms or phrases and (2) providing an example.

Therefore, the rejections of Claims 51-322 under 35 USC § 112, first paragraph are withdrawn.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a) because they fail to show the details of each block as described in the specification. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Each block in Figures 2, 4, and 5 has to be labeled. Correction is required.

4. The drawings are objected to because Figures 6 and 7 do not include labels for the axes shown in the figures. Correction is required.

Specification

5. The disclosure is objected to because of the following informalities.

a. In the amendment files on 2/9/2001, a phase factor δ_s is used in the second equation in page 5. However, how to give a value of δ_s is not disclosed. Can it be any number? Or shall it be derived from the input data? If it is the latter, the step of derivation is not shown.

b. In second paragraph, page 8 of the original specification, the Applicant stated that "a Fourier transform processor encodes each data element as parameters of a Fourier component in Fourier space and store the data parameter values to the Input Layer section 24 of the memory 20." An example of a Fourier series in Fourier space is given by the equation shown in page 8. $N_{m\rho 0}$, N_{mz0}, ρ_{0m}, and z_{0m} in the equation are designated as the data parameters.

The paragraph has created confusion to the present examiner about how to implement the steps with the equation, because "Fourier transform" has a well-defined meaning mathematically. The transform, based on the equation shown in page 8, is not Fourier transform of the raw data, but transform to a frequency domain of a set of functions related to the raw data. It is improper to imply the transform, based on the equation shown in page 8, to be a Fourier transform of the raw data. Such an implication also cause the confusion whether $N_{m\rho 0}$, N_{mz0}, ρ_{0m}, and z_{0m} are inputs because they are associated with *data* or outputs of this transformation because they are associated with *parameters*?

On June 6, 2001, Examiner Chen had an interview with Mr. Jeffrey S. Meicher, Dr. Randell L. Mills, and Mrs. Jeffrey A. Simenauer. Examiner Chen thanks Dr. Mills for explaining the implementation of the steps by using the data obtained from the CCD array as an example. Dr. Mills stated that *the procedure disclosed in page 8 is not the conventional Fourier transform. The encoding procedure is to input data to generate parameters. The parameters are then used to generate the function described by the equation shown page 8. In the equation, k_z and k_ρ are independent variables of the function which is a wave function. The end result is Fourier series of some function related to the input data. The step of "encoding" is just associating the input*

data with the function as specified by the equation. Signal representing the function can be used for correlation later on.

In the example, Dr. Mills explicitly made the following statements:

-- The "m" is an index to a CCD element, say element m.

-- $N_{m\rho 0}$, N_{mz0}, ρ_{0m}, and z_{0m} are derived from the amplitude of signal generated at the element m or the rate of change of the signal.

-- With the derived $N_{m\rho 0}$, N_{mz0}, ρ_{0m}, and z_{0m}, a Fourier component is generated.

-- M is the number of CCD elements used for the processing. Each Fourier component is also indexed with a "m."

-- The combination of the M Fourier components forms a Fourier series.

To reduce confusion, the Examiner here made the following suggestions. (1) While applicant may be his or her own lexicographer, the Examiner recommends changing "Fourier transform processor" to other term such as "frequency space processor" to distinguish the Applicant's processor from the conventional "Fourier transform processor." The frequency can be temporal or spatial frequencies. Or the applicant can state clearly that the Fourier transform is not the direct transform of the input data, but transform of a function related to the input data. (2) Define the meaning of m and M. (3) Replacing "encoding each data element as parameters" with "generating parameters with each data element." (4) State explicitly that "using the parameters together with wave functions to form a series."

Claim Objections

6. Claims 71-74 and 181-184 are objected to as being exactly duplicates of claims 79-82 and 189-192, respectively.

7. Claims 229-236 are objected to because of the following informalities.

   -- For Claims 229-236, a term "medium" shall be inserted after "computer-readable" in line 1 of each of the claims.

   Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

   > The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 127-155, 237-265, and 294-298 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for the following reasons.

   There are insufficient antecedent bases for the following limitations.

   -- Claim 127 recites the limitation "the high level memory" in the "s" step.

   -- Claim 237 recites the limitation "the high level memory" in the "s" step.

   -- Claim 294 recites the limitation "the high level memory" in the "s" step.

10. Claims 61-64, 71-86, 98-113, 123-126, 138-145, 148-155, 171-174, 181-196, 208-223, 233-236, 248-255, and 258-265 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such

omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are explained below.

Claim 51 calls for "encoding data as parameters of a plurality of Fourier components" and "adding ... said Fourier components to form ... Fourier series." Claim 61 further specify the "data" and the "Fourier series" that comprises the "Fourier components." Because the link between "data" and the "parameters" are not recited, Claim 61 is incomplete. Similar reason is also applied to Claims 71, 75, 79, 83, 98, 102, 106, 110, 123, 138, 142, 148, 152, 171, 181, 185, 189, 193, 208, 212, 216, 220, 233, 248, 252, 258, and 262.

The rejection can be overcome by changing "encoding data as parameters", or using similar term, in the highest-level claims to "encoding the data as data parameters." For example, inserting "the" before "data" in line 3, Claim 51 links inputted data to parameters. Inserting "data" before "parameters" in line 3, Claim 51 makes the inputted data connect to the equation recited in Claim 61.

Claim Rejections - 35 USC § 101

11. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

12. Claims 127-155, 237-265, 294-298, and 307-322 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

The claimed invention is a computer related invention. The Computer-Implemented Invention Guidelines issued by the U.S. Patent and Trademark Office describe the procedures for examining such inventions. A flow chart of the procedures is attached at the end of the Action.

For Claims 307-322, we examined them according to box 6 in the flow chart. The step in box 6 is to determine whether the invention as defined by the claims falls within one of the three following categories of unpatentable subject matter: (1) Functional descriptive material such as a data structure per se or a computer program per se, (2) Non-functional descriptive material such as music, literary works or pure data, embodied on a computer readable medium; or (3) A natural phenomenon such as energy or magnetism. *The invention as defined by Claims 307-322 is a data structure per se and therefore is non-statutory. The data stored in Claims 307-322 are those like music recorded in a disk.*

For Claims 127-155, 237-265, and 294-298, the invention as defined by the claims pass all the tests up to box 8. Claims 127-155 and 294-298 define only a series of steps to be performed on a computer and thus need clearly to be tested further.

Claims 237-265 recite a computer-readable medium. These claims appear at first glance to define a product for performing a process. Do they define a specific manufacture? If so, the claims are statutory under 101. However, there is no specific structure recited in these claims. The computer-readable medium is just a vehicle to carry software code. Therefore, they will be analyzed as a series of steps to be performed on a computer.

A series of steps implemented on a computer may be statutory if it falls within one of the two safe harbors under the Guidelines. The claimed invention would be statutory if it performed independent physical acts such as post-computer process activity. The claimed invention would

also be statutory if it had pre-computer process activity, such as manipulation of data representing physical objects. As shown in Fig. 4 of the application, the steps of the claims are for assigning specific data to replace the variables in the algorithm. All of the steps receive and output data purely within a computer. The claimed invention performs neither of pre- or post-computer process activities. The claims, therefore, are not statutory under the guidelines.

The claims will now be analyzed under the federal case laws that apply 35 U.S.C. Section 101 to computer algorithms.

The Supreme Court has held that abstract ideas are specifically excluded from patent protection by 35 U.S.C. Section 101. Diamond v Diehr, 450 U.S. 175, 209 USPQ 1, 7 (1981). Certain mathematical algorithms have been held to be non-statutory because they merely describe an abstract idea. An abstract idea may simply be any sequence of mathematical operations that are combined to solve a mathematical problem. The concern addressed by holding such subject matter non-statutory is that the mathematical operations merely describe an idea and do not define a process that represents a practical application of that idea. See In re Schrader, 22 F.2d 290, 30 USPQ2d 1455 (Fed. Cir. 1994) and cases discussed therein.

Accordingly, when a claim reciting a mathematical algorithm is found to define non-statutory subject matter, the basis of the Section 101 rejection must be that, when taken as a whole, the claim recites an abstract idea. Id. This rule can be applied by following a two step protocol designated as the Freeman-Walter-Abele test for statutory subject matter. Schrader, 30 USPQ2d at 1457. According to that test:

It is first determined whether a mathematical algorithm is recited directly or indirectly in the claim. If so, it is next determined whether the claimed invention as a whole is no more than

the algorithm itself; that is, whether the claim is directed to a mathematical algorithm that is not applied to or limited by physical elements or process steps. Such claims are nonstatutory. However, when the mathematical algorithm is applied to one or more elements of an otherwise statutory process claim, . . . the requirements of section 101 are met.

Applying the Freeman-Walter-Abele protocol to the claims, there is a mathematical algorithm recited in the claim. A mathematical algorithm for purposes of Section 101 is defined as a "procedure of solving a given type of mathematical problem . . . ." Gottschalk v Benson, 450 U.S. 63, 65, 175 USPQ 548 (1972). See also Diehr, 450 U.S. 175, 186, 209 USPQ 1 (1981).

Proceeding to the second stage of the analysis, the issue is to determine whether the claimed invention is otherwise statutory; that is, to determine what the claimed invention does, independent of how it is implemented. This is determined by asking whether there are any physical elements or non-mathematical process steps that apply to or limit the mathematical algorithm. See In re Abele 214 USPQ 682, 685(CCPA 1982), as supported by In re Iwashashi 12 USPQ2d 1908, 1911 (CAFC 1989) and In re Grams 12 USPQ 2d 1824, 1827 (CAFC 1989).

What elements or process steps, other than the mathematical algorithm, are present in the claims? When the algorithm is removed from the claim, what elements or steps are left? After removing the algorithm from the claim, there is no physical element or statutory non-mathematical process step present in the claim. Every functionally defined element in the claim is part of a mathematical algorithm.

The preamble phrase "for pattern recognition" is at best a field of use limitation. The Supreme Court has held that a field of use limitation cannot make a claim statutory by

"attempting to limit the use of the formula to a particular technological environment." Diehr, 209 USPQ at 10 (1981). Thus, the field of use limitation fails to render the claim statutory.

The steps of the claim are not limited to or defined by any physical elements or non-mathematical process steps. There is nothing physical about processing data per se. There are no physical elements or non-mathematical process steps recited in the claim, and there is no basis to read any physical or non-mathematical limitations into the claim.

When the claims are taken as a whole, the claims are directed to the preemption of a mathematical algorithm. Therefore, the claims are unpatentable because it merely manipulates an abstract idea and solves a purely mathematical problem without any limitation to a practical application. This conclusion is also supported by the inventor's statement provided in the interview. In the interview, the inventor claimed that the invention can be used in any field based on the data stored in the computer. For example, when the data are associated with image, music, nuclear process, and word, the claims can be used in object identification, voice recognition, nuclear reaction, and dictionary , respectively.

Claims 127-155, 237-265, and 294-298 define a computer algorithm without limitation to a practical application, such as a physical hardware computer for performing the algorithm, or specific software code embodied on computer readable medium along with the code's interaction with computer hardware for performing the algorithm, and are therefore unpatentable abstract ideas.

Claim Rejections - 35 USC § 102

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

14. Claims 157 and 266-267 are rejected under 35 U.S.C. 102(e) as being anticipated by Kortge (US patent 6,058,206.)

With regard to Claim 157, Kortge teaches a method for recognizing a pattern. The method comprises:

-- a.) generating an activation probability parameter based on a prior activation probability parameter and a weighting based on the activation rate of the corresponding component;

-- b.) storing the activation probability parameter;

-- c.) generating a probability operand based on the activation probability parameter;

-- d.) if the probability operand is a desired value, activate any component of the group recited in Claim 157, wherein a pattern is recognized when the operand is the desired value;

-- e.) repeating steps a) -d) until a pattern is recognized.

(The passage from column 12, line 3 to column 13, lines 30 teaches all of the steps a) -e). The probability is used to calculate the index of the most probable class. The index is a considered as probability operand. The index is computed based on the Bayes Rule. For example, the passage in column 7, lines 18-24 teaches a situation the index is "yes" for outputting the most probable symbol.)

Claims 266-267 are medium claims covering similar limitations of Claim 157. Kortge teaches a computer-readable medium to store data and processing steps. (column 9, lines 2-23)

15. Claims 271-272, 274, 276, 278, 281-283, 285-288, 290-291, 299-301, 304-309, and 312-320 are rejected under 35 U.S.C. 102(e) as being anticipated by Caid et al. (US patent 6,173,275.)

Caid teaches:

-- receiving data representative of physical characteristics within an input context of the physical characteristics and transforms the data into a Fourier series in Fourier space; (column 5, lines 1-16; column 5, line 61 to column 6, line 14; The wavelet transformation transforms data into Fourier series.)

-- receiving a plurality of the Fourier series from the memory, recognized a pattern, forms a string comprising a sum of Fourier series, and storing the string in a memory; (column 6, lines 42-67; The neural network has the associated layer. Each atom is a string comprising a sum of wavelet series.)

-- receiving the string, orders the wavelet series, forms complex ordered strings, and stores complex ordered strings; (column 10, lines 9-61; The summary vectors are the complex ordered strings.)

-- retrieving multiple ordered strings, forms complex ordered strings, stored the complex ordered strings, and activates the components of any of the layers of the system to recognize a pattern and establish an ordered formatted pattern; (column 12, line 18 to column 13, line 34)

-- a memory comprising a set of initial ordered Fourier series, multiple ordered strings, and complex ordered strings; (Column 3, lines 55 to column 4, line 2; column 6, lines 15-30; The

feature vectors are the set of initial ordered Fourier series. In a computer, they are stored in a memory.)

-- sampling and modulating at least two of the Fourier series with at least two filters to form the modulated Fourier series; (column 5, lines 61-67; Caid teaches generating features with Gabor wavelet transformation. It is well known in the art that Gabor wavelet transformation has the recited properties as discussed below in section related to Greenspan's paper.)

-- causing an activation of an associated Fourier components based on activation probability; (column 7, lines 14-30)

-- associating plurality of Fourier series based on a probability distribution; (column 7, lines 14-30; column 12, lines 7-44)

-- coupling based on spectral similarity. (column 4, lines 26-49; column 12, lines 7-44)

For medium claims, Caid further teaches:

-- a computer medium; (column 3, line 55 to column 4, lines 25)

-- program code means embedded in the computer readable medium. (column 3, line 55 to column 4, lines 25; the software components)

The Examiner likes to point out that the storage of strings in a tree structure recited in column 10, line 21 to column 13, line 40 discloses the concept of string, ordered string, and complex strings discussed in the present application. The processing steps lead to their recognition and arrangement teach the features of the above claims. The data structure of parent-child relationship discussed is in a tree hierarchically order of relative degree of association. The determination of frequency-of-occurrence for determining feature vectors is a process related to history.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. Claims 158-159 and 268-269 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kortge as applied to Claims 157 and 267 above, and further in view of Streit (US patent 5,724,487.)

Kortge teaches the parental Claims 157 and 267 as discussed above. Although the result of the Bayes rule can be an index of "1" when feature is classified as the identified class and "0", if not. However, Kortge does not teach explicitly using "0" and "1" as probability operands.

Streit teaches using "0" and "1" as probability operands for classification results. (column 5, lines 1-26) In which, the probability operand is selected from a set of zero and one with the desired value to be one.

It is desirable to facilitate a subsequent logic operation after classification process. It is well known in the art using symbols "0" and "1" can facilitate the logic process. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use "0" and "1" as probability operands taught by Streit for the result of classification process taught by Kortge, because the combination facilitates a subsequent logic operation for further action.

18. Claims 279-280, 289, 292-293, 302-303, and 321-322 are rejected under 35 U.S.C. 103(a) as being unpatentable over Caid as applied to Claims 271, 281, 291, 299, and 320 above, and further in view of Streit (US patent 5,724,487.)

Caid teaches the parental Claims 271, 281, 291, 299, and 320 as discussed above. Although the result of the classification rule can be an index of "1" when feature is classified as the identified class and "0", if not. However, Caid does not teach explicitly using "0" and "1" as probability operands.

Streit teaches using "0" and "1" as probability operands for classification results. (column 5, lines 1-26) In which, the probability operand is selected from a set of zero and one with the desired value to be one.

It is desirable to facilitate a subsequent logic operation after classification process. It is well known in the art using symbols "0" and "1" can facilitate the logic process. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use "0" and "1" as probability operands by Streit for the result of classification process taught by Caid, because the combination facilitates a subsequent logic operation for further action.

19. Claims 156, 270, 273, 275, and 284 are rejected under 35 U.S.C. 103(a) as being unpatentable over Caid et al. (US patent 6,173,275) in view of Dickhaus et al ("Classifying Biosignals with Wavelet Networks" by Dickhaus et al, IEEE Engineering in Medicine and Biology, September/October, 1996, pages 103-111.)

With regard to Claim 156, Caid teaches a system for recognizing a pattern and establishing an order formatted pattern. The system comprises:

-- an input layer that receives data representative of physical characteristics within an input context of the physical characteristics and transforms the data into a Fourier series in Fourier space; (column 5, lines 1-16; column 5, line 61 to column 6, line 14; The wavelet transformation transforms data into Fourier series.)

-- a memory comprising a set of initial ordered Fourier series; (Column 3, lines 55 to column 4, line 2; column 6, lines 15-30; The feature vectors are the set of initial ordered Fourier series. In a computer, they are stored in a memory.)

-- an association layer that receives a plurality of the Fourier series from the memory, recognized a pattern, forms a string comprising a sum of Fourier series, and storing the string in a memory; (column 6, lines 42-67; The neural network has the associated layer. Each atom is a string comprising a sum of wavelet series.)

-- a string ordering layer that receives the string, orders the wavelet series, forms complex ordered strings, and stores complex ordered strings; (column 10, lines 9-61; The summary vectors are the complex ordered strings.)

-- a predominant configuration layer that receives multiple ordered strings, forms complex ordered strings, stored the complex ordered strings, and activates the components of any of the layers of the system to recognize a pattern and establish an ordered formatted pattern. (column 12, line 18 to column 13, line 34)

For Claims 273, 274, and 284, Caid teaches their corresponding parental claims as discussed above.

However, Caid does not teach that the input context is encoded in time as delays corresponding to modulation of the Fourier series at corresponding frequencies.

It is well known, in the art of image data processing, that sequential read-out is a common and obvious step for reading out an image data.

Dickhaus teaches that a wavelet transformation encodes locations (the input context) of the data in time as delays as recited in the claim as evidently shown in Equations (1a)-(1c). In the paper, the shift parameter is a time variable and is encoded with the frequency f.

It is desirable to have flexibility of performing wavelet processing with various input formats, including the most common sequential reading of image data. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to include sequential reading of data for extract features by wavelet processing by Caid, because this inclusion provides operation flexibility. In the combination, a wavelet transformation inherently encodes locations (the input context) of the data in time as delays as taught by Dickhaus.

With regard to Claim 270, Caid further teaches a computer program product to carry out the above method and comprises:

-- a computer medium; (column 3, line 55 to column 4, lines 25)

-- program code means embedded in the computer readable medium. (column 3, line 55 to column 4, lines 25; The software components)

20. Claims 51-54, 57-60, and 118-120 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan et al. ("Texture Analysis via Unsupervised and supervised Learning," H. Greenspan et al. IJCNN-91-Seattle International Joint Conference on Neural Networks, 1991, vole. 1, pages 639-644.)

With regard to Claim 51, Greenspan teaches a method for recognizing a pattern in information, the method comprising:

-- inputting data; (Fig. 1; page 639; Data in a window is inputted at a time to cover the all image.)

-- encoding data as parameters of a plurality of Fourier components in Fourier space, adding at least two of the components together to form at least one Fourier series, sampling and modulating at least one of the Fourier series with a filter to form the modulated Fourier series; (In the section 2 "Feature Extraction Stage," Greenspan teaches generating features with Gabor wavelet transformation. It is well known in the art that Gabor wavelet transformation is given by

$$G(x', y', k_x, k_y, \sigma) = \Psi(x-x', y-y', k_x, k_y, \sigma)*I(x,y)$$

where I(x,y) is the inputted image data and * denotes linear convolution over the variable x and y, and x' and y' is the center of the window. $\Psi(x-x', y-y', k_x, k_y, \sigma)$ corresponds to a filtered Fourier component defined broadly by the Applicant. The parameters x' and y' are the position parameters. It is also well known in the art of wavelet transformation that a Gabor transform specified at location (x_0, y_0) is $G(x,y) = \exp(-\pi[(x-x_0)^2 \alpha^2 + (y-y_0)^2\beta^2])\exp(-2\pi i[(u_0(x-x_0)+v_0(y-y_0)])$. Each $G(x', y', k_x, k_y, \sigma)$ is a filtered Fourier series, because the transformation transforms the data in x-y space to a spatial-frequency k_x-k_y space. The Gaussian parts of Eq. 1 of the Greenspan's paper are the filters.)

-- determining a spectral similarity between the modulated series and another Fourier series; (Both unsupervised learning in Section 3 and supervised learning in Section 4 teach this feature. For example see paragraph 5 of section 3. The X is compared with the code-vector in the

unsupervised learning. The correlation between the input vectors and the output classes is performed.)

-- determining a probability expectation value based on the spectral similarity; (result of correlation in section 4)

-- generating a probability operand based on the probability; (section 4; The estimate of the probability of a given output is the probability operand.)

-- selecting a desired value for the probability for the probability operand, wherein recognition of a pattern is obtained when the probability operand having the desired value; (section 4; The largest estimate is the desired value.)

-- outputting a recognized pattern. (section 4; The input is labeled.)

With regard to Claim 118, Greenspan teaches a method for recognizing a pattern in information, the method comprising:

-- inputting information; (Fig. 1; page 639; Data in a window is inputted at a time to cover the all image.)

-- representing the information as a plurality of Fourier series in Fourier space and modulating and sampling the Fourier series with filters to formed the filtered Fourier series; (In the section 2 "Feature Extraction Stage," Greenspan teaches generating features with Gabor wavelet transformation. See above for property of Gabor wavelet transformation)

-- forming associations between at least two of the Fourier series by coupling the filtered series based on a probability distribution, wherein when at least two of the Fourier series have been associated recognition of a pattern in the information is achieved; (Both unsupervised

learning in Section 3 and supervised learning in Section 4 teach this feature. For example see paragraph 5 of section 3.)

-- outputting a recognized pattern in the information. (Both unsupervised learning in Section 3 and supervised learning in Section 4 teach this feature. For example see section 4.)

It is noted by the Examiner that Greenspan does not separate the steps of encoding, representing, filtering, and modulating explicitly recited in Claims 51 and 118. However, it is well known in the art of wavelet transform that the following two methods of performing the linear convolution are equivalent: (1) combining the Gaussian part and the complex exponential term first and then combined with I(x,y) for integration and (2) combining the complex exponential term with I(x,y) first and then combined the result with the Gaussian part for integration. Therefore, Greenspan's steps are equivalent to the steps recited in the claims.

It is desirable to have flexibility of various calculation methods for extracting features. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to include different combinations of calculation steps to extract features for pattern recognition used by Greenspan for the flexibility. The combinations would include the order of operation recited in Claims 51 and 118.

With regard to Claim 52, Greenspan further teaches that the modulated Fourier series and the another Fourier are added to form a string of Fourier series. (Each Fourier series is represented by a string. The last sentences of sections 3 and 4 teach that the feature vectors are combined and labeled together in the clustered domain. Thus they are added as a bigger string.)

With regard to Claim 53, Greenspan further teaches that string of Fourier series is stored in a memory. (1st paragraph of page 642; The various maps and the library are implicitly memories.)

With regard to Claim 54, Greenspan further teaches that said another Fourier series represents known information. (section 3, The code-vectors represents known information.)

With regard to Claims 57-58, Greenspan further teaches that modulating at least one of the Fourier components to provide an input context and the input context maps on a one to one basis to a physical context as recited in Claim 58. (Each x_0 and y_0 is used to index the location related to the Gabor transform as input context.)

With regard to Claim 59, Greenspan further teaches that each Fourier component comprises a quantized amplitude, a frequency, or phase angle. (Eq. 1 clearly shows the property.)

With regard to Claim 60, Greenspan further teaches that at least two Fourier series are provided. (A Fourier series is generated for each location in the image. There is more than one location existing in the image. Therefore, at least two series are provided.)

With regard to Claim 119, Greenspan further teaches that the coupling is based on spectral similarity of the Fourier series. (The feature vectors generated by the Gabor wavelet transformation are spectral information. The matching taught in section 3, paragraphs 3-4 teaches that spectral similarity is examined.)

With regard to Claim 120, Greenspan further teaches adding the associated Fourier series to form a string and ordering the string. (Each feature vector is a sequence of 20 parameters. When two series are associated, they are clustered, they are labeled with the same domain. As a consequence, both associated strings are combined into the same cluster. This is an ordering process.)

21. Claims 55, 87-90, 114, 117, 160-165, 167-170, 197-200, 224, and 227-230 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan cited above in view of Kortge (US patent 6,058,206.)

Greenspan teaches the parental Claim 51 as discussed above. However, Greenspan does not teach explicitly the repeating process as recited in Claim 55 and the transducer recited in Claim 161.

With regard to Claim 55, Kortge teaches:

-- a.) generating an activation probability parameter based on a prior activation probability parameter and a weighting based on the activation rate of the corresponding component;

-- b.) generating a probability operand based on the activation probability parameter;

-- c.) repeating steps a) -b) and the steps taught by Greenspan until a pattern is recognized.

(The passage from column12, line 3 to column 13, lines 30 teaches the repeating procedure.)

It is desirable to facilitate pattern classification. It can be achieved by iterative refinement of neural network. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to apply Kortge's teaching of iteration in the recognition system taught by Greenspan, because the combination can facilitate classification.

Claims 160, 162-165, and 167-170 recite medium claims corresponding to method Claims 51-54 and 57-60 discussed above. However, Greenspan does not teach explicitly a computer-readable medium.

Kortge teaches a computer-readable medium to store data and processing steps. (column 9, lines 2-23)

Furthermore Kortge teaches transducers recited in Claim 161. (column 10, lines 1-16)

With regard to Claims 87-90, 114, 117, 227, Kortge further teaches that there are photocells. The photocells indicate that there are at least two photocells and therefore two transducers. (column 10, lines 1-16) Kortge further teach recalling any part of the transducer string causing additional Fourier series to be recalled in column 11, lines 59-68. Combined with the discussion given above, the combination of Greenspan and Kortge also teaches Claims 87-90, 114, 117, and 227.

With regard to Claim 224, Kortge teaches the recited limitations as discussed above with regard to Claim 157.

It is desirable to have processing flexibility for pattern recognition. It can be achieved by using a computer with data and computer code stored in a computer-readable medium and using various transducers. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to apply Kortge's teaching of using (1) a computer with data and computer code stored in a computer-readable medium and (2) transducers to process the method taught by Greenspan, because the combination provides processing flexibility.

Claims 197-199 recite medium claims corresponding to method Claims 87-89 discussed above. They are rejected with the reason discussed above.

Claims 228-230 recite medium claims corresponding to method Claims 118-120 discussed above. They are rejected with the reason discussed above.

22. Claim 56 is rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan as applied to Claim 51 above, and further in view of Streit (US patent 5,724,487.)

Greenspan teaches the parental Claim 51 as discussed above. Although the result of the classification rule can be an index of "1" when feature is classified as the identified class and "0", if not. However, Greenspan does not teach explicitly using "0" and "1" as probability operands.

Streit teaches using "0" and "1" as probability operands for classification results. (column 5, lines 1-26) In which, the probability operand is selected from a set of zero and one with the desired value to be one.

It is desirable to facilitate a subsequent logic operation after classification process. It is well known in the art using symbols "0" and "1" can facilitate the logic process. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use "0" and "1" as probability operands taught by Streit for the result of classification process taught by Greenspan, because the combination facilitates a subsequent logic operation for further action.

23. Claims 115-116, 166, and 225-226 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan and Kortge as applied to Claims 114, 160, and 224 above, and further in view of Streit (US patent 5,724,487.)

The combination of Greenspan and Kortge teaches the parental Claims 114, 160 and 224 as discussed above. Although the result of the classification rule can be an index of "1" when feature is classified as the identified class and "0", if not. However, the combination of Greenspan and Kortge does not teach explicitly using "0" and "1" as probability operands.

Streit teaches using "0" and "1" as probability operands for classification results. (column 5, lines 1-26) In which, the probability operand is selected from a set of zero and one with the desired value to be one.

It is desirable to facilitate a subsequent logic operation after classification process. It is well known in the art using symbols "0" and "1" can facilitate the logic process. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use "0" and "1" as probability operands taught by Streit for the result of classification process taught by the combination of Greenspan and Kortge, because the combination facilitates a subsequent logic operation for further action.

24. Claims 65-66, 69-70, 91, 94-95, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan cited above in view of Dickhaus.

Greenspan teaches the parental Claims 51, 57 and 118 as discussed above.

However, Greenspan does not teach that the input context is encoded in time as delays corresponding to modulation of the Fourier series at corresponding frequencies.

It is well known, in the art of image data processing, that sequential read-out is a common and obvious step for reading out an image data. For example, a CCD is used to capture an image. The data in a CCD is read out sequentially. The stored data are usually read out from a memory sequentially. In the sequential readout scheme, $\Psi(x-x', y-y', k_x, k_y, \sigma) = \Psi(x-at, y-bt, k_x, k_y, \sigma)$, the $\Psi(x-at, y-bt, k_x, k_y, \sigma)$ specified at (x', y') is thus a time delayed version of $\Psi(x, y, k_x, k_y, \sigma)$ delayed in x and y directions.

Dickhaus teaches that a wavelet transformation encodes locations (the input context) of the data in time as delays as recited in the claim as evidently shown in Equations (1a)-(1c). In the paper, the shift parameter is a time variable and is encoded with the frequency f. Because data are sequentially obtained for wavelet process, the shift parameter is a time-delay variable and is encoded with the frequency f. The input context maps one to one to the location of data. The

modulation is represented by e $^{-j2\pi f\tau}$ as shown in Eq. (1c). For Claim 91, Equations (1a)-(1c) teaches that the filter is a time delayed Gaussian filter.

It is desirable to have flexibility of performing wavelet processing with various input formats, including the most common sequential reading of image data. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to include sequential reading of data for extract features by wavelet processing taught by Greenspan, because this inclusion provides operation flexibility. In the combination, a wavelet transformation inherently encodes locations (the input context) of the data in time as delays as Taught by Dickhaus.

It is also desirable to simplify the step of processing data that are outputted directly from a CCD or a memory in the most common sequential format. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use the time delay approach taught by Dickhaus to perform the delay version of $\Psi(x, y, k_x, k_y, \sigma)$ for filtering and modulating Greenspan's data in the Gabor wavelet transformation, because the combination makes the processing match pair of data more efficiently in the most common sequential format.

With respect to Claim 94, when x = at and y = bt is substitute into the following equation as explained above,

$$G(x,y) = \exp(-\pi[(x-x_0)^2 \alpha^2 + (y-y_0)^2\beta^2])\exp(-2\pi i[(u_0(x-x_0)+v_0(y-y_0)],$$

we have

$$G(x,y) = \exp(-\pi[(at-at0)^2 \alpha^2 + (bt-bt0)^2\beta^2])\exp(-2\pi i[(u_0(at-at0)+v_0(bt-bt0)]$$
$$= \exp(-\pi[(t-t0)^2 (a\alpha)^2 + (t-t0)^2 (b\beta)^2])\exp(-2\pi i[(au_0(t-t0)+bv_0(t-t0)].$$

As shown each x and y components of the filter are characterized in time as equivalent to that recited in Claim 94.

With regard to Claim 95, it is well known in mathematics that the above filter when expressed in frequency space is characterized equivalently by the expression recited in Claim 95.

25. Claims 175-176, 201, 203-205, and 231 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan and Kortge cited above, and further in view of Dickhaus.

The combination of Greenspan and Kortge teaches the parental Claims 167, 160, and 228 as discussed above.

However, the combination of Greenspan and Kortge does not teach that the input context is encoded in time as delays corresponding to modulation of the Fourier series at corresponding frequencies.

It is well known, in the art of image data processing, that sequential read-out is a common and obvious step for reading out an image data. For example, a CCD is used to capture an image. The data in a CCD is read out sequentially. The stored data are usually read out from a memory sequentially. In the sequential readout scheme, $\Psi(x-x', y-y', k_x, k_y, \sigma) = \Psi(x-at, y-bt, k_x, k_y, \sigma)$, the $\Psi(x-at, y-bt, k_x, k_y, \sigma)$ specified at (x', y') is thus a time delayed version of $\Psi(x, y, k_x, k_y, \sigma)$ delayed in x and y directions.

Dickhaus teaches that a wavelet transformation encodes locations (the input context) of the data in time as delays as recited in the claim as evidently shown in Equations (1a)-(1c). In the paper, the shift parameter is a time variable and is encoded with the frequency f. Because data are sequentially obtained for wavelet process, the shift parameter is a time-delay variable and is encoded with the frequency f. The input context maps one to one to the location of data. The modulation is represented by $e^{-j2\pi f\tau}$ as shown in Eq. (1c). For Claim 91, Equations (1a)-(1c) teaches that the filter is a time delayed Gaussian filter.

It is desirable to have flexibility of performing wavelet processing with various input formats, including the most common sequential reading of image data. It would have been

obvious to one of ordinary skill in the art, at the time of the invention, to include sequential reading of data for extract features by wavelet processing taught by Greenspan and Kortge, because this inclusion provides operation flexibility. In the combination, a wavelet transformation inherently encodes locations (the input context) of the data in time as delays as taught by Dickhaus.

26. Claims 92-93 are rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan and Dickhaus, and further in view of Levien (US patent 5,337,264.)

The combination of Greenspan and Dickhaus teaches the parental Claim 91 as discussed above. However it does not teach using cascaded stages to form a Gaussian filter.

Levien teaches using a cascade of filters with an exponential decay response to create a Gaussian filter. (column 2, lines 15-32)

It is desirable to have flexibility of performing wavelet processing in software, hardware, or hybrid approach. The hardware approach can provide high process speed. One requirement to perform wavelet processing with hardware is to use a hardware Gaussian filter. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use Levien's Gaussian filter to provide the wavelet feature for the system taught by Greenspan and Dickhaus , because the overall combination provides operation flexibility and increases process speed.

27. Claim 202 is rejected under 35 U.S.C. 103(a) as being unpatentable over Greenspan, Kortge, and Dickhaus, and further in view of Levien (US patent 5,337,264.)

The combination of Greenspan, Kortge, and Dickhaus teaches the parental Claim 201 as discussed above. However it does not teach using cascaded stages to form a Gaussian filter.

Levien teaches using a cascade of filters with an exponential decay response to create a Gaussian filter. (column 2, lines 15-32)

It is desirable to have flexibility of performing wavelet processing in software, hardware, or hybrid approach. The hardware approach can provide high process speed. One requirement to perform wavelet processing with hardware is to use a hardware Gaussian filter. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to use Levien's Gaussian filter to provide the wavelet feature for the system taught by Greenspan, Kortge, and Dickhaus, because the overall combination provides operation flexibility and increases process speed.

Allowable Subject Matter

28. Claims 67-68 and 177-180 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 181-184 would be allowable if rewritten to overcome (1) the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims and (2) the objection set forth above.

Claims 185-196 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Claims 310-311 are not rejectable over the prior art on recorded, although they are rejected under 35 U.S.C. 101.

The following is a statement of reasons for the indication of allowable subject matter. The prior art fails to teach the method of Claim 67 and medium Claim 177 which specifically comprises: the relationship of the nth level sub components, the n+1 sub time intervals, the time delay, frequency, and input context as recited in Claims 67 and 177.

29. Claims 71-74 and 233-236 would be allowable if rewritten to overcome (1) the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims and (2) the objection set forth above.

Claims 61-64, 75-86, 123-126, and 171-174 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter. The prior art fails to teach the method or medium of Claims 61, 71, 75, 79, 123, 171, and 233 which specifically comprises: the specific equations for transforming data into frequency (Fourier) domain as recited in the Claims, respectively. Their dependent claims accordingly possess allowable subject matter.

30. Claims 96-97, 206-207, and 277 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 98-113 and 208-223 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Claim 232 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten (1) in independent form including all of the limitations of the base claim and any intervening claims and (2) to overcome claim objection set forth above.

The following is a statement of reasons for the indication of allowable subject matter. The prior art fails to teach the method or medium of Claims 96 and 206 which specifically comprises: a probability expectation value is based on (1) the spectral similarity of the modulated Fourier series and another Fourier series as recited in Claims 51 and 160 and (2) Poissonian probability.

31. Claims 127-155, 237-265, and 294-298 are not rejectable over the prior art on recorded.

Claims 127-155, 237-265, and 294-298 are rejected under 35 U.S.C. 112, second paragraph and 35 U.S.C. 101.

However, the prior art fails to teach the method or medium of Claims 127, 237, and 294 which specifically comprises detailed steps of obtaining, filtering, and modulating strings, updating Fourier series, recalling summed Fourier series, forming updated summed Fourier series and the comparison, recognition, storage of the Fourier strings as recited in Claims 127, 237, and 294.

Conclusion

32. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wenpeng Chen whose telephone number is 703 306-2796. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 703 308-7452. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications. TC 2600's customer service number is 703-306-0377.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 305-4700.

Wenpeng Chen
Examiner
Art Unit 2624

July 17, 2001

WENPENG CHEN
PRIMARY EXAMINER

Wenpeng Chen